

PROCEEDINGS
OF THE
ROYAL SOCIETY OF EDINBURGH.

VOL. X.

1878-79.

No. 103.

NINETY-SIXTH SESSION.

Monday, 26th November 1878.

SIR WILLIAM THOMSON in the Chair.

The following Council were elected:—

President.

PROFESSOR KELLAND, M.A.

Honorary Vice-Presidents.

HIS GRACE THE DUKE OF ARGYLL

SIR ROBERT CHRISTISON, BART., M.D.

SIR WILLIAM THOMSON, KNT., LL.D.

Vice-Presidents.

DAVID STEVENSON, Memb. Inst. C.E.

The Right Rev. Bishop COTTERILL.

Principal Sir ALEX. GRANT, Bart.

DAVID MILNE HOME, LL.D.

Sir C. WYVILLE THOMSON, LL.D.

Prof. DOUGLAS MACLAGAN, M.D.

General Secretary—Dr JOHN HUTTON BALFOUR.

Secretaries to Ordinary Meetings.

Professor TAIT.

Professor TURNER.

Treasurer—DAVID SMITH, Esq.

Curator of Library and Museum—ALEXANDER BUCHAN, M.A.

Councillors.

Professor FLEEMING JENKIN.

Rev. R. BOOG WATSON.

Dr HUGH CLEGHORN.

Professor T. R. FRASER.

Professor RUTHERFORD.

Dr R. M. FERGUSON.

Rev. W. LINDSAY ALEXANDER, D.D.

Dr THOMAS A. G. BALFOUR.

J. Y. BUCHANAN, M.A.

Rev. THOMAS BROWN.

ROBERT GRAY.

Dr WILLIAM ROBERTSON.

Monday, 2d December 1878.

Professor KELLAND, the President, read the following Introductory Address :—

In taking my place this evening, I might reasonably be expected to say much about my unworthiness to fill the post, and the kindness of my friends in placing me here. All that I can trust myself to say is, that I feel too deeply everything that can be imagined of this kind to venture on giving it words. To be the successor of such men as the Duke of Argyll, Sir Robert Christison, and Sir Wm. Thomson, is an honour which the most ambitious man might covet, and the most self-conceited deem himself scarce worthy of. To myself that honour has come neither to gratify ambition nor to administer to self-conceit. It has descended on me all unsought through the kindness of the many friends who have sat with me for years in this room, and the only emotion it awakens is that of affection and gratitude. Just a month has elapsed since it became apparent to me that I should be called upon to address you to-night. That such would be the case had not till then crossed my thoughts. I had made no preparation for the address. The first month of the University session left me the very smallest amount of time and strength for the work. You will, therefore, pardon an address rather feeble in character than is fitted to the occasion. Happily, the kindness of friends has aided me very materially in the preparation of the obituary notices. Mr Milne Home has placed at my disposal documents, both in print and in MS., relative to Sir Richard Griffith—the latter, unfortunately, arrived late on Saturday evening, when I had completed my brief sketch of Sir Richard, but I hope it may be allowed me to avail myself of these documents in preparing the sketch for the press. Sir Robert Christison has kindly furnished remembrances of Hugh Scott of Gala and Sir James Coxe, of which I have availed myself; and Mr Gordon, through Professor Balfour, has furnished me with sundry published obituary notices. I have to add that the notice of Fries is entirely due to Professor Balfour, that of Regnault to Professors Tait and Crum Brown, that of Claude Bernard to Professor Rutherford, that of Mr Cunningham to Professor Duns, and that of Harkness to Professor Geikie. The notice of Martyn Roberts is due to his family.

The following statement in regard to the number of the present Fellows of the Society has been drawn up by the Secretary :—

1. Honorary Fellows—

Royal Personage—

His Royal Highness the Prince of Wales, . . . 1

British Subjects—

John Couch Adams, Esq., Cambridge ; Sir George Biddell Airy, Greenwich ; Thomas Andrews, M.D., Belfast (Queen's College) ; Thomas Carlyle, Esq., London ; Arthur Cayley, Esq., Cambridge ; Charles Darwin, Esq., Down, Bromley, Kent ; John Anthony Froude, Esq., London ; Thomas Henry Huxley, LL.D., London ; James Prescott Joule, LL.D., Cliffpoint, Higher Broughton, Manchester ; William Lassell, Esq., Maidenhead ; Rev. Dr Humphrey Lloyd, Dublin ; William Hallowes Miller, LL.D., Cambridge ; Richard Owen, Esq., London ; Thomas Romney Robinson, D.D., Armagh ; General Sir Edward Sabine, R.A., London ; Henry John Stephen Smith, Esq., Oxford ; Professor Balfour Stewart, Manchester ; George Gabriel Stokes, Esq., Cambridge ; James Joseph Sylvester, LL.D., Baltimore ; Alfred Tennyson, Esq., Freshwater, Isle of Wight, . . . 20

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Foreign—

Robert Wilhelm Bunsen, Heidelberg ; Michel Eugène Chevreul, Paris ; James D. Dana, LL.D., Newhaven, Connecticut ; Alphonse de Candolle, Geneva ; Heinrich Wilhelm Dove, Berlin ; Jean Baptiste Dumas, Paris ; Charles Dupin, Paris ; Professor Carl Gegenbaur, Heidelberg ; Herman Helmholtz, Berlin ; August Kekulé, Bonn ; Gustav Robert Kirchhoff, Heidelberg ; Herman Kolbe, Leipzig ; Albert Kölliker, Würzburg ; Ernst Eduard Kummer, Berlin ; Johann von Lamont, Munich ; Richard Lepsius, Berlin ; Ferdinand de Lesseps, Paris ; Rudolph Leuckart, Leipzig ; Joseph Liouville, Paris ; Carl Ludwig, Leipzig ; Professor J. N. Madvig, Copenhagen ; Henri Milne-Edwards, Paris ; Theodor Mommsen, Berlin ; Louis Pasteur, Paris ; Professor Benjamin Peirce, U.S. Survey ; Karl Theodor von

Carry forward, 21

Brought forward,	21	
Siebold, Munich; Otto Struve, Pulkowa, St Petersburg; Bernard Studer, Berne; Otto Torell, Lund; Rudolph Virchow, Berlin; Wilhelm Eduard Weber, Göttingen; Friedrich Wöhler, Göttingen,	32	
Total number of Honorary Fellows at November 1878,	—	53

The following are the Honorary Fellows deceased during the year :—

<i>Foreign</i> —Victor Regnault, Claude Bernard, Elias Magnus Fries, Angelo Secchi,	4	
<i>British</i> —Sir Richard Griffith,	1	
	—	5

2. Ordinary Fellows—

Ordinary Fellows at November 1877,	373	
<i>New Fellows</i> , 1877–78.—W. H. Allchin, M.R.C.P.; Dr Andrew Peebles Aitken; John Frederick Bateman, Esq.; Charles Davidson Bell, Esq.; James Blyth, Esq.; James Brunlees, Esq.; Dr John Archibald Campbell; Dr Daniel John Cunningham; John Grahame Dalziel, Esq.; Dr Samuel Drew; Dr J. J. Kirk Duncanson; James Alfred Ewing, Esq.; R. K. Galloway, Esq.; Lord Inverurie; William King, Esq.; P. R. Scott Lang, Esq.; Alan Macdougall, Esq.; Dr Alexander Macfarlane; John Milne, Esq.; George M'Gowan, Esq.; Dr Richard Norris; James R. Stewart, Esq.; Robert Macfie Thorburn, Esq.; Rev. John Wilson,	24	397
<i>Deduct Deceased</i> .—Hugh Scott, Esq. of Gala; Sir William Stirling Maxwell, Bart.; Sir William Gibson-Craig, Bart.; Sir James Coxe; Professor Robert Harkness; Dr James Watson; James Cunningham, Esq., W.S.; Martyn J. Roberts, Esq.; Dr Edward James Shearman; Dr James Allan, who died in 1852, but whose death was only intimated in 1878,	10	
<i>Resigned</i> .—Dr Thomas Smith Maccall; Dr Thomas E. Thorpe,	2	12
Total number of Ordinary Fellows at November 1878,	385	
Add Honorary Fellows,	53	
Total Ordinary and Honorary Fellows at commencement of Session 1878–79,	438	

During the last Session, the Neill Prize for the triennial period 1874-77 was awarded to Dr Traquair for his paper on the "Structure and Affinities of *Tristichopterus alatus*" (Egerton), published in the twenty-seventh volume of our "Transactions;" and also for the many contributions he has made to the knowledge of the structure of recent and fossil fishes.

Among our Foreign Honorary Fellows, HENRI VICTOR REGNAULT deservedly held a foremost place, especially as an experimental philosopher, alike in chemistry and in physics. Born at Aix-la-Chapelle, July 21st 1811, he came to Paris in his early youth with the sole object of obtaining a livelihood. While engaged as a shopman in a bazaar, he made such good use of his scanty leisure as to qualify himself for admission to the *École Polytechnique* (1830). In 1832 he became a pupil in the *École des Mines*. Thereafter he was for sometime a Professor in Lyons; but, in 1840, returned to Paris, having been elected a Member of the Academy of Sciences in consequence of important investigations in Organic Chemistry. He became, in 1847, *Ingénieur-en-chef* of the second class, and Professor of Chemistry in the *École Polytechnique*, and of Physics in the *Collège de France*, and was made Director of the Imperial Porcelain Manufactory at Sèvres in 1854.

Regnault's first published chemical work was on the action of potash on the oil of the Dutch chemists (1835). His discovery of the bodies now known as chloride, bromide, and iodide of vinyl had a very important bearing on the development of the radical theory, and his speculations on the relations of these substances to aldehyde brought about a temporary agreement in opinion as to the constitution of acetic acid and analogous substances between Berzelius, Liebig, and Dumas.

In 1838 and 1839, Regnault published investigations on the action of chlorine on the oil of Dutch chemists and on hydrochloric ether. He stated, in a very precise form, a view as to the persistency of molecular arrangement, which (along with the views already expressed by Dumas and by Laurent) contributed to found the "Substitution Theory," over which Berzelius and the French chemists had a long and bitter controversy. The two investigations

just referred to led to the discovery of cases of isomerism of great theoretical importance.

Regnault's investigations of specific heat of metals reduced the number of apparent exceptions to the law of Dulong and Petit, and induced him to propose (in 1840-41, and again in 1849) the change in the atomic weights of silver and of the alkali metals, which was afterwards strongly advocated by Cannizzaro, and is now generally adopted.

In physical work Regnault was distinguished rather for extreme skill in manipulation and patient study of details (especially in the investigation of necessary corrections) than for brilliance or novelty in discovery. He was an admirable experimenter, and may be said to have done almost as much good to science by training a school of skilled experimenters as by his own extended researches. He devoted himself specially to the accurate determination of physical constants, such as latent and specific heats, to the laws of expansion of gases and vapours, to the determination of the densities of gases, and specially to the accurate measurement of temperature.

His greatest work, forming Volume XXI. of the *Mémoires de l'Académie des Sciences*, was undertaken for the French Government, and contains most elaborate experimental determinations of the various physical data required for investigations of the working of steam engines. Besides numerous other chemical and physical papers (a complete list of which will be found in the Royal Society's catalogue of scientific papers), Regnault published, in four volumes, an "Elementary Course of Chemistry," which has been long and deservedly successful.

The death, during the siege of Paris, of his only son, who was rapidly advancing to high distinction as a painter, seems to have clouded his later years, and he died on January 19, 1878, at the age of 67.

CLAUDE BERNARD.—By the recent death of Claude Bernard, France has lost her greatest physiologist, and this Society one of the most distinguished of its Foreign Associates.

Bernard was born in 1814, at St Julien in France; he studied medicine in Paris, became assistant to Magendie, resolved to devote

his life to the pursuit of physiology, and at the age of 40 he was appointed to a chair of physiology, specially created for him by the Faculty of Sciences of Paris.

The services which he rendered to physiology and medicine are so eminently distinguished, that his name must be ranked with those of Harvey and Haller, of Bichat and Müller, of Magendie and Charles Bell. Bichat and Magendie were his countrymen, and it was by the brilliant teaching and example of Magendie that he was inspired, and induced to offer his genius and his labour to the cause of physiological science.

The great influence of Magendie's teaching over the young mind of Bernard was due to the circumstance, that as a teacher of an experimental science he did not content himself with the delivery of mere didactic discourses, but sought, as far as lay in his power, to experimentally demonstrate the truth of what he stated, and the several steps by which that truth had been ascertained. The truths of physiological science thus received a living power which no mere words could give, and the evolution of Bernard as a physiologist was one of its results.

One of his great discoveries had reference to the liver, an organ whose function—although it is imperfectly comprehended even now—was greatly elucidated by his researches. Previous to his time, it was supposed that the secretion of bile was the only function of this organ; Bernard, however, made the remarkable discovery that the liver also produces glycogen—a starch-like substance which is converted into grape-sugar as it passes from the liver into the blood. This discovery greatly advanced our conceptions of the nature of the chemical processes that take place in the animal organism, for it was previously supposed that starch and sugar are produced by the tissues of plants only.

With regard to the sugar-forming function of the liver, Bernard also discovered that by injuring a certain part of the medulla oblongata of a rabbit, the sugar-forming function of the liver is greatly exaggerated. The excess of sugar poured into the blood is excreted by the kidneys, and thus the disease known as diabetes is artificially induced. Probably no discovery ever produced a more startling effect on the medical world; for this simple experiment on a *rabbit* afforded the first rational explanation of a disease that is

far from being rare in the human subject, and which had completely baffled the skill of physicians to furnish any reasonable theory as to its causes.

Another of his great discoveries had reference to the influence of the nervous system over the bloodvessels. He showed that the bloodvessels are influenced by two sets of nerves—one causing diminution of their calibre by exciting their muscular fibres to contraction, the other giving rise to dilation of the vessels.

This discovery offered for the first time the true explanation of changes in the calibre of the bloodvessels occurring in the various bodily organs during their states of rest and activity; and which are commonly observed in the face in the conditions of blushing and pallor. The whole question of the innervation of the bloodvessels is one of great difficulty, which in many of its details even now baffles the investigator; yet although Bernard did not at first fully grasp the significance of some of his experiments, he nevertheless gave the key to all the subsequent observations; and the accuracy of not one of his experiments has ever been gainsaid. His *observations* were exact, although his interpretations were not in every case entirely correct.

Another of his great investigations had reference to the function of the pancreas. By an elaborate research, he proved that the fluid which this important organ pours into the alimentary canal powerfully affects the fatty elements of the food, converting them into an emulsion, and partly saponifying them, so that they may be readily absorbed by the lacteals.

Another important research had reference to the effects of *carbonic oxide* and *curara*. He showed that carbonic oxide produces suffocation by combining with the blood-pigment, and thus rendering that substance unable to discharge its normal function of conveying oxygen from the lungs to the tissues.

With regard to the Indian arrow poison—*curara*, he proved that it produces a paralysis of motion by acting on the terminations of the motor nerves in the muscles. The method of physiological analysis by which he proved this is a model for all researches of a similar nature.

The importance of Bernard's researches on these poisonous substances lay in the circumstance that they were conducted from a

physiological point of view ; and they may be said to have been the first to convince the leaders of medical thought, that a true knowledge of the actions of poisonous and medicinal agents can only be arrived at by a thorough investigation of their effects on the animal organism in a *state of health*, combined with observations of their effects in *diseased conditions*. A wide stream of research already flows from this conviction, and practical medicine is constantly deriving increasing benefit therefrom.

In addition to these—his greatest works—Bernard also made important observations on the functions of the fifth, seventh, and eighth cranial nerves ; on recurrent sensibility ; on the secretion of the salivary, gastric, and intestinal juices ; on the temperature of the blood in the right and left sides of the heart ; on the gases of the blood and their variations as the blood circulates through organs in a state of rest as compared with a state of activity ; on the modifications in the secretions of the stomach and intestinal canal after removal of the kidneys ; and on the production of albuminuria by lesions of the nervous system.

Bernard was adored by his pupils, not only because of his greatness as an investigator and as a teacher, but also on account of the enthusiasm with which he inspired them, and the unceasing spirit of affection and encouragement which he ever manifested towards them. Happily for physiology and for medicine, he gave no countenance to that sentiment which would deter from performing a painful experiment on an animal, for the purpose of eventually saving pain and saving life both of man and of animals ; while it is silent with regard to the vast amount of suffering inflicted on animals for purposes that are frivolous and unnecessary.

Those who knew Bernard best can aver that he was a man of kindly disposition, who lived a blameless life, and devoted himself faithfully and only too earnestly to the advancement of medical science,—almost to the very day of his death, on the 10th day of February last.

He deserved well of his country, for he had done as much as the greatest of his predecessors, and the most renowned of his contemporaries, to keep her in the foremost rank of science ; and France was not slow to recognise the greatness and the unselfish character of the service he had rendered to her, as well as to science ; for her

deputies unanimously awarded to him the pomp and ceremony of a State funeral, thus magnifying his name and his example.

He was worthy of the exceptional honour which France paid to his memory, and his name and his work will last while medical science endures.

Happily for France, his mantle has worthily fallen on Brown-Séquard, Paul Bert, Vulpian, Marey, and Moreau, who have already amply proved themselves worthy of so great a master.

We have to record the death of another Honorary Fellow of the Society—ELIAS MAGNUS FRIES, a distinguished Professor of Botany in the University of Upsala, in Sweden. He was born at Smaland in August 1794, and died at Upsala on the 8th of February 1878. His father was pastor at Femsjö, and was fond of botanical pursuits. Even at an early period of life young Fries accompanied his father on botanical rambles. During one of them he picked a very showy species of *Hydnum*, which seems to have turned his mind to the study of *Agarics* and other fungi.

Fries was one of the great promoters of Scandinavian science. His works embraced all departments of botany, but his attention was specially directed to Lichens and Fungi. His early studies were prosecuted at a school in Wexiö. In 1811 he became a pupil at the University of Lund, where he studied under Schwartz, Agardh, and Retzius. In 1814 he was chosen Docent of Botany. At this time he published his first work, entitled "*Novitiæ Floræ Suecicæ*." In 1847 he was elected a member of the Royal Academy of Sweden, and in 1851 he became Professor of Botany in the University of Upsala, vacant by the resignation of Wahlenberg. This chair he continued to occupy until within a few years of his death. He continued to publish works in the Scandinavian language, specially on Mycology and Lichenology, up to 1874. The state of Fries' health did not permit him to join the great celebration of the 400th anniversary of the University of Upsala in September 1877. He presented some of his foreign botanical friends with copies of his photograph on the occasion. His son is now Professor of Botany at Upsala. In the Royal Society's Catalogue of Scientific Papers there are enumerated eighty-five separate publications by Fries, extending from the year 1816 to the year 1874.

ANGELO SECCHI was born at Reggio on the 29th June 1818, and received his early education in the schools of the Jesuit Fathers. He at the outset distinguished himself in mathematics and physics, and for a time lectured on those subjects in the Collegio Romano. In 1844 he commenced his theological studies. Three years later, on the Revolution of 1847, he was obliged to take refuge in England, and was ordained priest at the College of Stonyhurst. From thence he passed to America, and was made Professor of Physics in Georgetown College, where, however, he remained only a very short time. The death, in 1848, in London, of Father Francesco di Vico, Director of the Observatory and Professor of Astronomy in the Collegio Romano, brought Secchi back from America as his successor. Here he laboured for thirty years in accumulating and publishing observations, astronomical and meteorological, for which the Papal Government, aided by private liberality, furnished him with excellent instruments and an ample personal staff. His astronomical observations were published in three vols. 4to, extending from 1851 to 1856. So far as I know, they came down no further.

Secchi, though an excellent observer and a man of great power, was of a discursive turn of mind. He had little power of concentration, and appears early to have tired of the monotony of astronomical observations, and to have turned his attention to the more popular studies of terrestrial magnetism and solar physics. His attention to the latter subject had probably been aroused by his having assisted Professor Henry, when in America, in making the first experiments on the heat radiated by different portions of the sun's disc, by means of the thermo-electric pile. His interest in spectroscopy dates from Janssen's first visit to Rome, and he turned it to good account, having published, in 1847 and 1848, spectroscopic observations on more than three hundred stars. The same subject is treated in a volume entitled "The Stars," published first about the time of his death, which will, it is believed, prove to be a work of great importance, and likely to procure for its author a lasting reputation.

In 1871 there was formed a Society, calling itself the *Società degli Spettroscopisti Italiani*, two of the principal workers in which were Secchi at Rome and Tacchini at Palermo. Thanks to the liberal supply of funds by the Government, the two observa-

tories of Palermo and Rome were enabled to carry on a daily series of combined observations, principally on the sun. The results of these observations and of the other labours of this Society are published periodically at Palermo, and have already reached the seventh volume. Secchi photographed the eclipse of 1860 in Spain, and observed that of 1870 in Sicily.

In 1862 Secchi commenced a monthly series in 4to, entitled the *Buletino Meteorologico*, consisting of daily observations, meteorologic and magnetic, made both at the college and at various places in the neighbourhood of Rome, as well as of observations made on the sun's spots. This collection, now edited by Father Ferrari, has reached its sixteenth volume.

The grand *Exposition Universelle* of 1867 procured a favourable opportunity of exhibiting his registering meteorograph in Paris, for which he obtained the great French prize of 100,000 francs (?) and the Grand Cross of the Legion of Honour, which the Emperor Napoleon conferred on him with his own hand. He took the opportunity whilst in Paris of delivering some lectures, a portion of which have been published in French, in 2 vols. 4to, under the title of *Le Soleil*.

When the Collegio Romano passed from the Papal to the Italian Government, the Chair of Astronomy in the new Roman University was offered to Secchi and accepted, but the chief of his order would not allow him to retain it. His connection with the Observatory did not, however, cease.

Secchi's reputation was undoubtedly very great and wide-spread. He was member of a very large number of scientific societies. Amongst the rest, the Royal Society of London elected him one of their foreign members in 1856, and our Society followed their example in 1865. His great merit consisted in industry and activity—his error, in want of definiteness of aim, in over-production. The Royal Society's Catalogue of Scientific Papers contains a list, carried down to 1863 only, of no less than 230 contributions to scientific journals. At the time of his death, which took place on the 26th of February last, this list must have been greatly extended. Their value is probably not in proportion to their extent; but it cannot be doubted that they contain much that will help on the future progress of science.

MR HUGH SCOTT of Gala was born in 1822. He held a commission as captain in the 92d Highlanders, and was afterwards major in the Dumfries, Roxburgh, and Selkirkshire Militia. He was a Justice of the Peace and Deputy-Lieutenant of the county of Selkirk, and an enthusiastic supporter of the Episcopal Church of Scotland, whose cause he advocated for years in the local and Edinburgh newspapers. His descent, both by his father's side and that of his mother (who was daughter of Sir Archibald Hope of Craighall), secured him a good position amongst the landed gentry of Scotland, and his personal qualities were of the highest order. Spite of a marked stutter, he shone in society, and was always a general favourite; indeed, it may be doubted whether this defect of speech is not an aid rather than a hindrance to its possessor, whether as a converser or as a lecturer. Charles Kingsley was a notable example amongst those who have passed away; and many members of this Society will call to mind living examples illustrative of the truth of this remark.

Mr Scott died at Hyères, whither he had gone in search of health, on the 19th of December last.

JAMES CUNNINGHAM, Esq., W.S., was born at Edinburgh on the 18th of March 1800. He died on the 6th of November 1878. His father, Alexander Cunningham, W.S., was a lineal descendant of Alexander Cunningham the historian, younger son of the Rev. James Cunningham, who was ordained minister of Ettrick in 1641. Alexander Cunningham's grandfather married a sister of Dr Robertson, Principal of the University of Edinburgh, and grand-uncle of the late Lord Brougham. In Chambers's edition of Burns, Alexander Cunningham is referred to as the chief Edinburgh friend of the poet. Mr Cunningham was educated at the High School of Edinburgh, in Mr Gray's class, along with the late Lord Neaves, Professor Syme, Dr James Begbie, and other afterwards well-known citizens. After serving an apprenticeship in the office of Messrs Gibson-Craigs & Wardlaw, W.S., he was admitted a member of the Society of Writers to Her Majesty's Signet in 1823, and shortly after he began practice as a Writer to the Signet in partnership with the late James Walker, Esq. He retired from business in 1852, and in the same year was elected a Fellow of this Society,

whose meetings he attended with much regularity, and in whose proceedings he took a great interest. The personal friend of the leading Scottish naturalists of the generation now passing away, Mr Cunningham was a most intelligent and earnest amateur student of natural science.

Mr Cunningham was twice married—first, in 1836, to Margaret Sheaffe Bagot, sister of the Rev. Daniel Bagot, Dean of Drumore; and secondly, in 1846, to Elizabeth, daughter of Alexander Dunlop of Keppoch, and sister of the late Alexander Murray Dunlop of Corsock. Mrs Cunningham, four sons, and a daughter survive.

DR JAMES WATSON was a native of Glasgow, where he was born on the 11th of September 1792. He was educated at the High School and University of Edinburgh, where he took the degree of M.D. in 1812, before he had completed his twentieth year. Early in life he received the appointment of assistant-surgeon in the East India Company's service, and resided for nearly twenty years in India. On his return from India in 1831 he retired from the Company's service, and shortly afterwards settled in Bath, where he soon acquired a very large practice, and was unquestionably the leading physician in Bath and the adjacent counties. Amongst his other patients must be noted Prince Louis Napoleon after his escape from Ham. He was an enthusiastic member of his profession, devoting himself to hospital work with untiring zeal, and in his later years of comparative leisure bringing the experience of his lengthened career to bear on the subjects of hospital administration and hospital finance. In private life he was a pleasant and instructive companion, with a vigorous intellect, which remained unclouded to the last. He died on the 27th of September last, having just completed his eighty-sixth year.

DR EDWARD JAMES SHEARMAN was a native of Wington, in Somersetshire. The house in which he was born was next door to that of Mrs Hannah More. Very soon after completing his medical studies he settled in Rotherham, where he practised his profession for the space of upwards of fifty years. His contributions to medical literature have been numerous and varied. The particular department to which he appears largely to have devoted his atten-

tion was the use of the microscope as a guide to the diagnosis and the prevention of disease. More than a year before the publication of the first edition of Dr Golding Bird's "Urinary Deposits," he read before the Sheffield Medico-Chirurgical Society an "Essay on the Changes in the Urine affected by Disease, and the Tests to distinguish them," which was published in the *Lancet*. He became medical officer to the Rotherham Board of Health, but his microscopic examination of the town water gave such offence to that Board that they speedily got rid of him. He had, however, done his work, and he cared little for the consequences. He had thoroughly opened the eyes of the people, and a new era followed. In his scientific tastes he was somewhat discursive, and too apt to wander from subject to subject. To this circumstance we may attribute his failure to attain that eminence amongst his contemporaries which his talents and enthusiastic devotion to his profession, and to every study connected with it, would have secured him, had he concentrated his attention on some special subject. As it was, he was a useful and thoroughly instructed medical man, loved and respected by a wide circle of patients and friends. He died in his eighty-first year.

SIR JAMES COXE was born at Gorgie in 1811. His father died when he was young, and the bringing up of the family devolved on his mother, the sister of George and Andrew Combe.

In early life he pursued his studies on the Continent, and acquired a competent knowledge of French and German. He graduated in the University of Edinburgh in 1835, and shortly afterwards joined the College of Physicians, on the list of whose Fellows he stood fourth at his death. From the commencement of his professional career he gave considerable attention to diseases of the mind, in which he was no doubt encouraged by his uncles the Combes. He was naturally of a shy and reserved disposition, and thus his good points, indomitable industry and strong common sense, were long hidden from the public, to his no small injury. Indeed, had it not been for his marriage in 1841, to the sister of Dr William Cumming, which resulted in his being brought under the notice of the Duke of Argyll, he might probably have waited long for the opportunity of making his powers known to the world. As it was, Sir James

was appointed in 1855 Member of a Royal Commission to inquire into the management of the insane in Scotland. The writing of the Report fell chiefly to Sir James, and it disclosed such a chaotic condition of the arrangements for the care of the insane, and such an amount of neglect and cruelty, as shocked and surprised Parliament and the country. To the ability with which this Report was drawn up may be attributed Sir James's ultimate position in his profession. The Report was presented to Parliament in 1857, and it led in the same year to the passing of Lord Moncreiff's Lunacy Act. Under this Act Sir James became one of the paid Commissioners, which appointment he held till his death, giving to the discharge of his duties the most earnest and conscientious attention.* The first fifteen of the Reports of the Commissioners were entirely written by Sir James, and they prove incontestably that he was a man pre-eminently fitted for the post, not only by his early education and his acquired tastes, but by his power of concentration, which led him to throw his whole life into the work. He visited English and Continental establishments for the care of the insane, and made himself master of their methods of treatment. He thus became strong in his efforts to improve the state of things at home. At his suggestion amendments were made in the Act of 1857, in 1862, and again in 1866, and these have given it a character so special as to attract the attention of Continental and Colonial Governments. Sir James was fortunate in having Dr Arthur Mitchell as a colleague, as the successor to Dr Browne, when he was unfortunately laid aside by blindness. Dr Mitchell not only stood with him in carrying out his views during his life, but is in a position to keep up their efficient working now that he is gone. Sir James was examined before the Parliamentary Committee on Lunacy in 1877, and his evidence was reckoned the most valuable given on that occasion.

As a literary man, he devoted his time mainly to assisting his uncles in their labours, and during the last two or three years of his life he gave much of his spare time to the superintendence of the

* He was ably supported by his co-commissioner Dr W. A. F. Browne, one of the most eminent of British psychologists, who was instrumental in introducing the modern system of treatment of the insane in the Montrose Asylum and the Crichton Royal Institution, Dumfries.

memoir of his uncle George Combe, written by Mr Charles Gibbon. Sir James received the honour of Knighthood in 1843—an honour well merited from the zeal and devotion with which he pursued a line of conduct which has resulted, spite of much opposition, in conferring great benefits on his country. The personal character and general bearing of Sir James were such as in a good cause to overcome opposition; determined but quiet, armed at every point, but cautious in the use of his weapons, himself thoroughly convinced, but never treating lightly the opposite convictions of others, he was enabled to discharge his delicate and difficult duties in a manner to bear down opposition so softly and insensibly as to leave no trace of wounds behind. He was seized with illness in Paris, whither he had gone for relaxation, and died at Folkstone on the 9th of May last.

SIR RICHARD GRIFFITH, who has been styled “the Father of Irish Geology,” was born in Dublin on the 20th of September 1784. He was descended from a Welsh family of distinction, his ancestors having come over to Ireland about the commencement of the seventeenth century, and acquired considerable property in various parts of the country. The bulk of the property having lapsed from the family through failure of issue, the grandfather of Sir Richard disposed of the remainder, and settled in Mellicent, county Kildare, marrying a kinswoman (Miss Elizabeth Griffith, of Glamorganshire), by whom he had issue Richard Griffith, the father of the deceased. The son, also named Richard, was educated in Dublin, with a view to obtaining a commission in the Irish Artillery, in which he succeeded in 1799 after passing the usual examination. He retained his appointment only a short time, the Act of Union having broken up the separate establishments of the two countries. The offer was, indeed, made him of an appointment in the British forces, but his father caused him to decline it, conceiving that a better opening was afforded him in the practice of civil engineering. He accordingly directed his attention to the study of mines, and at seventeen proceeded to Cornwall, with the view of gaining a practical knowledge of mining. Here his assiduity attracted the attention of Sir Humphry Davy. On Mr Griffith discovering in the Dalcoath mine the rich ores of nickel and cobalt which were raised with the silver ore,

but had till then been rejected as rubbish, Lord de Dunstanville, one of the principal proprietors of the mines, offered him a permanent appointment in them, which, however, he declined, preferring to give his studies a wider range, probably with a view to devote his powers to the service of his native country. He accordingly visited the mining districts of Derbyshire, Yorkshire, Durham, and Northumberland. This brought him to Edinburgh, where he formed the acquaintance of Sir James Hall, Professors Playfair, Jamieson, and Hope, by whom he was held in such high estimation, that in 1808, when only twenty-three years of age, he was unanimously elected a Fellow of this Society. He now returned to Dublin, and, under the influence of the Royal Dublin Society, at once commenced "a geological and mining examination of the Leinster coal district." The publication of the results of his labours in this field was completed in 1814. In 1809 he was selected by the Commission appointed to inquire into the practicability of draining and improving the bogs of Ireland to be one of their engineers. In 1812 his surveys and reports were published by the authority of Parliament. At this date he received the appointment of Inspector-General of the Royal Mines in Ireland, as successor to the eminent mineralogist Richard Kirwan. Three years later he issued the first instalment of a geological map of his native country, to which he regularly made additions during the space of forty years, when it was published in a completed form. The Geological Society of London in 1855, in recognition of its value, awarded him the Wollaston Palladium Medal. Professor Edward Forbes, in presenting the medal, described the map as "one of the most remarkable productions which had ever been effected by a single geologist." This map he had the honour of presenting personally to Her Majesty, who took a lively interest in it. The result was that in 1858 Griffith was created a Baronet.

It is a remarkable testimony to the knowledge which Sir Richard had early acquired of the geology of his native country, that in the map he had coloured a district as Upper Silurian, whilst the officers of the Geological Survey who followed him held it to belong to a formation between the Silurian and the Old Red Sandstone. Sir Richard, however, adhered to his opinion. To get the matter settled, Mr Hall, the present director of the Geological Survey of

Ireland, went during last autumn with some of his staff to the district, and became satisfied of the correctness of Sir Richard's view. He at once communicated the fact to Sir Richard in a letter, which, however, reached him too late to give him the satisfaction which it was intended and calculated to afford.

The famine in the south of Ireland, which occurred in 1822, aroused the then Lord-Lieutenant, the Marquis of Wellesley, to energetic action in the improvement of the means of communication between different parts of the country. He accordingly appointed Griffith as engineer, to improve and construct roads in the counties of Cork, Kerry, and Limerick. Under his direction the starving population were employed to construct some 250 miles of road through districts hitherto accessible only with great difficulty, and not a little danger from the disaffected population, whom it was not easy to render amenable to British authority. While engaged in this work he received the important appointment of General Boundary Surveyor, the magnitude of whose duties may be inferred from the fact that 1000 miles of the boundaries of about 69,000 Crown lands had to be ascertained and settled. In 1827 he was appointed Commissioner of Valuation under Mr Goulburn's Act, and "Griffith's Valuation" was accepted as the test of value in nearly all the land disputes in Ireland. In 1846, after the great potato famine, he was appointed Deputy-Chairman of the Board of Works, the onerous duties of which appointment he performed regardless of self, working thirteen hours a day without food or drink, feeling that the lives of thousands depended on his exertions. It will not be necessary to allude to the various appointments which he held during his long life, nor to the numerous public works which were executed under his superintendence. That which is best known in his native city was the diversion of the course of the Liffey, and the conversion of a group of dilapidated houses, the nursery of vice and fever, into the esplanade which stands in front of the Royal Barracks.

Sir Richard Griffith was seventy-four years of age when he was created a Baronet, an age at which most men relax from their labours or cease them altogether. It was very different with Sir Richard. He had still twenty years of good work left in him. The preservation of his physical and mental powers for so long a period

he attributed to his temperate habits of living, being an early riser and remarkably abstemious. At eighty, when on a geological excursion with his friend Mr Milne Home, he once walked eighteen miles in a day. He continued to give and receive hospitalities as late as to his ninety-second year. In private life he was upright and honourable, kindly and sociable. He was married in 1812 to Miss Waldie of Hendersyde Park, Kelso, with whom he celebrated a golden wedding in 1862. His long and useful life was brought to a close on the 22d September 1878.

Mr Milne Home, who knew him well, has kindly communicated to me some of Sir Richard's letters to members of his family. They breathe a tone of simple and unaffected piety, which gilds the other virtues of this excellent man.

In the death of Sir WILLIAM STIRLING MAXWELL, Scotland has lost (to use the words of Lord Houghton) her first man of letters. Sir William's name is familiar to literary men on both sides of the Tweed, not as the Baronet, but as simply William Stirling of Keir. With that name he commenced his career, with that name he obtained his earliest and brightest laurels, and with that name he will descend to posterity.

He was born at Kenmure, near Glasgow, on the 8th March 1818. On his father's side he was descended from the Stirlings of Keir, retainers of the house of Stuart, and famous in history. On his mother's side he traced his pedigree up to the battle of Otterburn, where had been shed the blood of a Maxwell of Pollock. His after career was tinged with his ancestral associations, which operated to throw his mind with affection back on the past.

Mr Stirling completed his early education by taking the degree of B.A. in Cambridge in 1839. He was Fellow Commoner of Trinity College during my residence in the University, but, so far as I know, did not distinguish himself as a student. He devoted himself rather to art and history than to those early studies which constitute the framework of the training of a University. His love for travel was early developed, and the ample means at his disposal enabled him to indulge in it in a manner and to an extent not in the power of ordinary students. It was during his residence at Cambridge as an undergraduate that he made the tour in Palestine,

which brought out his first appearance in print in a small volume, entitled "The Songs of the Holy Land." Like most young men, Stirling's first essays in writing were in verse, and like most wise men, his efforts in verse ceased with the first effusion. His good genius left him free ever after to express himself in prose. After leaving Cambridge he lived much on the Continent; and having a facility for the acquisition of languages, he became a tolerable proficient in French, Italian, and Spanish. It was the last-named language, and the literature which it opened up, that seized on his youthful mind and influenced the whole current of his future thoughts. Spain was at that time little visited by the British traveller, and the literature of the country was to the ordinary student sealed up in an unknown tongue. Prescott and Ford, and others with them, have since given us an insight into the treasures, artistic and literary, which are stored up in the Peninsula. To Stirling they came with all the freshness of original discovery.

The early history of the Moor and the Cid, tinctured with romance, and having its roots in the struggles of the mind after religion, was peculiarly attractive to a young man whose natural bent was to the sombre in art and the ascetic in religion. He returned again and again to Spain, and familiarised himself with her literature and her art—so unlike the literature and art of northern Europe. To the latter branch of study he at first devoted his attention. Spanish art, unlike Italian, is characterised by its positive features of religion and decorum, and is no less marked by its negative features of deficiency in landscape, in marine, and in animal painting. The Church, the supreme power in Spain, discouraged the study of anatomy; and the result is, that the subjects in which the Italians most delighted were shunned or neglected by the Spaniards. The consequence was, that to those whose education was based on the Italian school, the Spanish treatment of sacred subjects seemed dry and unintelligible. Thus, whilst Raphael and Michael Angelo were familiar to the minds of our countrymen (as they deserved to be), the not much inferior, but very different, greatness of Morales, of Zurbaran, and of Velazquez was but coldly recognised. Few had seen them in the Madrid gallery, and the few who had seen even Velazquez, the greatest of them, had not yet begun to recognise him as the artist who "drew the minds of men."

Wilkie, writing half a century ago, described the Peninsula as "an unexplored territory—the very Timbuctoo of art." "Madrid," says he, writing to Sir Robert Peel, "is quite a mine of old pictures of which in England we know nothing." Stirling's mind was admirably adapted to fit him to be the explorer of this mine. Accordingly, the first fruits of his travels and studies in Spain were given to the world in 1848 in his "*Annals of Spanish Painters*." Sir Edmund Head had preceded him by a year in the publication of his "*Handbook to the History of the Spanish and French Schools of Painting*," and Stirling's book came, as it were, to clothe the dry bones of Head's work with living flesh. It scattered over the dull details of biography anecdotes bearing on the manners and customs of the different epochs which his history brought under his eye. It gives in some sort a glimpse at the history of the Spanish people. The book was received with enthusiasm, and placed the author at once in the front rank of art critics. It was a great success, but it must be confessed that it was a success in a narrow field; and had the author rested on his laurels he would have ere now dwindled into a comparatively small figure among his contemporaries. Fortunately for us, his intercourse with Spain and Spanish story, and his accurate history-loving mind, brought him into contact with a hero congenial to his tastes, with whose career, as a Scotchman and an admirer of the brilliant pages of Robertson, he must have been familiar from his youth—Spain's greatest or second greatest name, Charles V.

But Mr Stirling was no hero-worshipper; and when he follows Charles into the cloister, it is with no intention of painting him with the halo of a saint, but with the stern yet noble features of a man who, having adopted as his motto "*Plus ultra*," thus striking the negative from the limits of his ambition, paused in mid career that he might look out from the quiet eminence of his tower at Yuste, and witness, undisturbed by its noise, the working of the vast machine himself had set in motion.

"*The Cloister Life of Charles V.*," Mr Stirling's greatest work, originated in this way. A MS., entitled "*Memoir of Charles at Yuste*," had been deposited in the archives of the Foreign Office at Paris. Mr Stirling, anxious to solve some question in Spanish history, went there in the summer of 1850, and endeavoured in vain to get a sight of it. Nothing daunted, he returned in the

winter, backed by Lord Normanby, and finding favour with the President of the Republic, he was, though not without great difficulty, at length permitted to peruse the precious MS. He found it a real treasure, based as it was on the correspondence of the Emperor Charles from his place of retreat, with the courts of Valladolid and Brussels. The information derived from the perusal of this MS. (which he was not allowed to copy) supplied the groundwork of Mr Stirling's volume, on which, from his ample resources in Spanish literature, he founded the true story of Charles's cloister life, so different from the life depicted in the charming pages of Robertson. We see the Emperor setting out from Flanders in a truly imperial manner, accompanied by his two sisters, queens of Hungary and France, with a train of 150 followers and a fleet of 60 sail. We see him arrived at Burgos amidst the pealing of bells and the shouts of the populace. We follow him threading the mountain passes of Spain till he reaches the castle of the Count of Oropesas, sick and worn out, not with fasting and prayer, but with excessive indulgence at table. We hear of the whole country-side aroused at his advent, and we have not long to wait till we find every pass which leads to his retirement threaded by strings of sumpter mules laden with everything which nature and art could find out to administer to Charles's inordinate love of good cheer. We see him at length in his cell at Yuste—a cell which had been three years in its construction, built especially for his use—with sixty attendants only, feasting right royally every day, and in all respects (if Mr Stirling has not somewhat overstated his case, which is more than probable) as much a man of the world and an emperor as he had ever been at Valladolid or in Brussels. To his countrymen (who had been enamoured with Charles's cloister life from reading of it only in the fascinating pages of Robertson) the effect produced by Mr Stirling's book must have been somewhat analogous to the deletion of one of the saints from their calendar.

Mr Stirling having completed for the present his historical studies, returned to his first love—Spanish art, and three years later he published "*Velazquez and his Works*," a singularly able monograph.

It is not necessary in this place to notice the works which were privately printed at his expense, mostly illustrative of Spanish history and art. It is to be regretted that their circulation was

limited to a few friends and to the public libraries, so as to be nearly inaccessible to the general reader; nor is it my duty more than to mention the production, in a splendid form, of the history, by Mr W. Fraser, of the Stirlings of Keir. Lord Houghton informs us that at the time of his death Sir William had announced the speedy completion of the "Life of Don Juan of Austria."

Mr Stirling received academic honours from nearly every University in Britain. In particular, he had been elected Lord Rector of the University of Edinburgh, and at his death he was Chancellor of the University of Glasgow. The rectorial address which he delivered to the students in Edinburgh is characteristic of the man. It recommends caution in forming an opinion, hesitation in choosing a party, whether in politics or in religion, and, above all, sober-mindedness. I quote one passage:—"Let me recommend to your notice the rule of Descartes—the first of the code which he composed for the guidance of his own mind—'Never to receive anything for truth which I do not clearly know to be true—that is, carefully to avoid haste and prejudice, and to include in my judgment nothing which does not present itself so clearly and distinctly to my mind as to take away all occasion of doubt.' If any considerable number of men could be induced to walk by this rule, how blessed a calm would descend upon many places now filled with noise and confusion! how many of our intellectual battle-fields would be left with 'their lances unlifted, their trumpets unblown,' ready for the ploughshare of profitable industry! how much speech, which can be hardly called even silver, would be hushed in a happy and golden silence!"

Sir William died of fever at Venice on the 15th January.

Sir WILLIAM GIBSON-CRAIG, the eldest son of Sir James Gibson-Craig of Riccarton, Bart., was born on the 2d of August 1797. He traced his descent to Sir Alexander Gibson, who was President of the Court of Session in the reign of James VI., and a daughter of Thomas Craig of Reccarton, the celebrated jurist of that time, and author of the treatise *De Jure Feudali*. Having been educated at the Edinburgh High School, and afterwards at a school in Yorkshire, he was called to the Scotch bar in 1820; but instead of settling down to a forensic career, he spent two years in foreign travel, and on his

return to Edinburgh, turned his attention to public affairs. He took an active part in Church matters, and on the dissolution of Parliament which followed the accession of Queen Victoria in 1837, he offered himself for the representation of his native county, Mid-Lothian, and was returned by a majority of 42. Four years later he retired from the representation of the county, and offered himself for that of the city of Edinburgh. He was returned as the successful candidate along with Mr Macaulay, and retained his seat till 1852, having held during six years of the period the post of a Lord of the Treasury, in which position he had endeavoured to take a real charge of the affairs of Scotland. To him perhaps more than to any other man we are indebted for the erection of the National Gallery. In 1862 he was appointed to the office of Lord Clerk Register and Keeper of the Signet in Scotland; and in the following year he was sworn a member of Her Majesty's Privy Council. For many years Sir William performed the duties of this office of Lord Clerk Register gratuitously. Subsequently, on the recommendation of a select Committee of the House of Commons, which took evidence on various matters connected with the Register House, the salary of £1200 a year, which had formerly been attached to the office, was restored about 1871. Sir William exerted himself to render the working of the Register House efficient, and in particular to carry out the recommendations of the committee above referred to. Amongst other objects which engaged his attention was the publication of many of the interesting documents contained in the Register House. One undertaking he thus helped to forward was the index volume to Thomson's Acts of Parliament prepared by Professor Cosmo Innes, and the recasting of a portion of that work, with the addition of Acts discovered since Thomson's time. Another was the collection of Privy Council Records, edited by Mr Hill Burton, of which the first volume has been published. For many years Sir William acted as Chairman of the Board of Visitors of the Royal Observatory, on which Board I had the pleasure of sitting with him. Here he brought to bear his knowledge of the forms and usages customary in approaching the Treasury, and he was a steady and efficient supporter of the Astronomer Royal in his endeavours to get the Observatory put on a proper footing. To all connected with him on that Board his conduct was ever that of a high-minded

and courteous gentleman, and his retirement was a source of deep regret to all his colleagues.

Sir William died on the 12th of March, in his 81st year.

MARTYN JOHN ROBERTS, born August 2, 1806, was the only child of John Roberts and Caroline, the daughter of William Yalden, of an old Hampshire family. His father resided at "Bryn Caeran, Caermarthenshire," and did not think it necessary to bring up his son to any profession or business, but he soon made himself acquainted with all the mining and other industrial occupations in the district. Early in life, he manifested a great distaste for mere classical learning, and an immense avidity for scientific pursuits; and as science was not to be acquired at school or at home, he found out every thing for himself while discouraged by all those around him. Amongst the Welsh servants and peasantry, he was considered somewhat in the light of a magician, owing to the extraordinary experiments he was always making; and in thus teaching himself, he often rediscovered many facts already known to others with whose works he could not then become acquainted. But had he heard of them he could not have been satisfied without proving them. He had a rare combination of exact scientific research with flashes of imagination, and thus the study of electricity always possessed a peculiar charm for him. There, he saw a very imperfectly explored and wonderful region with plenty of room for experiment and discovery.

He was never all his life without a carpenter and smith working out his ideas, so needful was it for him to create a tangible representation of them, and so unable was he with his refined, nervous fingers to do any rough manual work for himself. Both his parents died before he was of age. He began his independent career by having a yacht built on his own plan, and sailed about to visit various places abroad, making acquaintance with Cuvier, Clement-Desormes, and other scientific men in Paris. Thus he came in contact with all that had been already done in science, and knew over what field his future investigations must range. In this way also he made himself thoroughly master of navigation, and was qualified to suggest improvements regarding ships. Hence, we find him, July 9, 1838, receiving thanks from the United Service

Museum for a new form of anchor deposited there; and early in 1839, a medal was conferred on him by "the Society of Arts of Scotland," for his new method of reshipping a rudder at sea, an account of which was published in the *Edinburgh New Philosophical Journal*, No. 53. Some of his contributions on the subject of electricity may be briefly noticed, but as his thoughts were sown broadcast by extempore lectures and in newspapers, it is impossible to do more than allude to them generally.

He always combated the notion of inherent repulsion, whether in gravity or electricity, and as, by independent research, the phenomena of electricity gradually opened out to him, he became convinced that gravity was dependent on an electric condition, and that there were not two electric fluids, essentially positive and negative, repellent and attractive, but only one fluid, either "plus" or "minus" in quantity or intensity, and always attractive. He maintained that apparent repulsion could be explained by one attractive fluid, always tending to equilibrium, and he wrote and lectured much to account for the phenomena generally supposed to be adverse to his theory. The papers published in the *London and Dublin Philosophical Magazine*, vol. xix., July 1841, and vol. xxi., 1842, show that while studying anatomy at the Edinburgh University in 1838, he was collecting materials to prosecute his favourite researches in electricity. It was chiefly but not entirely with reference to these papers, that the late Dr Grant (professor of comparative anatomy at the London University) wrote as follows:—"In the whole range of my experience, no one surpassed Roberts for deep and original views in practical chemistry and physiology."

He initiated several forms of galvanic battery. The first mentioned by him, he applied more especially to the assaying of copper ores in October 1837, also to the blasting of rocks; and in September 1838 he sent papers on both subjects to the Royal Geological Society, Cornwall, describing his method of effecting those objects. It was on that occasion that he was unanimously elected Member of this Society. The following November a letter from him, explaining the process, was read by Mr J. P. Gassiot at the London Electrical Society, of which he was one of the earliest members. Another letter, dated March 1839, was read at the same Society, describing a new battery in which the metals were circular discs, and were

arranged on a horizontal axis, so that by turning a handle they might be rotated. There was an apparatus for cleansing the plates as they turned, and additional galvanic energy was obtained after exposure to the air.

That was the battery used in blasting the Skerryvore rocks. Other papers of his are to be found in the "Proceedings of the London Electrical Society," 1837-40 and 1843, pp. 77, 78, 356-60, "On Radiation not a property of Electricity," &c., &c. To conclude the subject of blasting, it may be as well to say that on the 26th March and 26th April 1838 (at the request of the Highland and Agricultural Society of Scotland) he exhibited, not only his process of blasting rocks, but that of explosion under water, at Craigeleith Quarry, for the perfect success of which he received a medal from the Society. A drawing of the scene, showing the height to which the water rose, was made at the time, and afterwards engraved. Some sappers and miners, then present, being taught the process, made it known to Colonel Pasley, and the result was his blowing up the "Royal George." It was not, however, until 1840 that (by desire of many) he published a pamphlet, giving simple, practical directions for general work, and detailing the use he had made of sand for tamping, and the introduction of atmospheric air between the charge of powder and the sand, so as to increase the energy of explosion. He first pointed out that sand so placed in a tube could not be blown out. In the "Proceedings of the Highland and Agricultural Society" may be seen the original paper, of which the pamphlet was a copy, and it was still further illustrated in the "Proceedings of the West Yorkshire Geological Society" for 1842-48, pp. 126-138. The last act of the kind he personally superintended was in a quarry near Rydal, to please the poet Wordsworth and Dr Davy. In the "Mining Journal" a controversy was begun 18th January 1841, and ended by two letters—one from Mr Byers, stating that he had made much practical use of assaying ores by galvanism, the idea of which originated with and was communicated to him by Mr Roberts; the other was from Mr Roberts himself, showing that M. Becquerel's essay "On Detecting Metals in their Solutions" did not bear on the subject, as he did not profess to give any practical method for detecting the quantity and variety of metals contained in the ore.

Mr Roberts set out on a scientific expedition to Norway in the

summer of 1839, but was detained for some time at Amsterdam by rheumatic fever, and obliged to return home from great prostration. Throughout many years of his life he suffered from frequent attacks of the same kind, often checking him in the midst of work. However, he was not long after this ready with a paper "On an Anomalous Condition of Iron." Experiments were detailed, showing iron to be positive when compared with copper, and yet far more highly negative than copper when compared in their electric relation with zinc. The result of this newly discovered fact was, that he recommended to the Admiralty a new method of sheathing ships, and made known the use to which it might be applied in the manufacture of boilers.

In 1851 he contrived a battery for obtaining products that might be utilised in the arts, and thus cheapen the use of electricity, but soon afterwards those products became so plentiful as to be of little commercial value.

For the same purpose, he recovered his products and used them over and over again without much waste. It is interesting, at the present moment, to read the description of an electric lamp, for which he then took out a patent, but which was not carried into general use for want of sufficient funds. The distance between the graphite or charcoal electrodes was regulated by a kind of clockwork, and two sets of electrodes used to produce equality of light, or else "the electrodes were placed in a vacuum, or space not containing any oxygen or other matter which could cause their destruction when brought into an incandescent state by the action of the current of electricity." The specification, with full drawings, dated 1852, No. 14, 198, may afford some hints for those at work in a similar direction now. It may not have been known to those who have lately proposed the same thing, but the coincidence is singular. While visiting the manufacturing districts of Glasgow and Leeds, he used his chemical knowledge to improve the making of paints and dyeing of woollen cloths, and also helped in reducing the friction of spindles. It should here be mentioned that, in the course of his life he took out several patents, but a mind so sensitive as his was not fitted for the wear and anxiety of commercial speculation, and the fertility of his thoughts would not allow him (like the man of one idea) to rest long on anything he

had done. He had scarcely constructed one machine before he shot right ahead of it, and thought of something better, which his honesty, and candour would not allow him to conceal. His last invention was a safety-valve most carefully superintended by himself, and being his last, it is to be hoped that those who have taken out a patent for it will be rewarded by a pecuniary profit he did not derive from anything for himself.

Wherever he stayed, he was one of the first to found and promote mechanics' institutions; and many were his lectures on science, freely given to working men, by whom he was, in consequence, much regarded, and from many of whom he afterwards received letters thanking him for the impetus he had given to their intelligent industry and prosperity.

When in the Highlands, he interested himself much in the condition of the crofters, and his suggestions on that subject were published in the newspapers of the day. The people of Fort William must remember his gathering them of an evening for rational amusement and instruction.

In 1854 his love of fine scenery induced him to purchase a picturesque property in Breconshire, where he built a house, and settled his family for eighteen years. The land, which he found full of stony hedgerows and swampy places, he made a verdant park, and planted it with many fine trees.

But the work in which he took most interest there was the administration of justice, as deputy-lieutenant and magistrate for two counties. He was not satisfied with a mere "dilettante" observance of his duty, but studied and mastered the laws on the knowledge of which he was to make a decision. As a visitor of the United Lunatic Asylum at Abergavenny, he always threw light on the subjects discussed, and his ideas were gathered up in pamphlets and periodicals that might influence the community in which he lived. Some of his suggestions respecting "the poor laws" were afterwards adopted. His "Plea for Pauper Children," advocating industrial and classified schools, was published in 1861. He also made a move against the injustice done to poor people by deficient weights and measures, and was called upon to give evidence on them before a Committee of the House of Commons, which led to a more stringent regulation. On that occasion, the Astronomer Royal showed his

power of memory. Hearing the name of "Martyn Roberts" he asked, "Did you as a boy write me a remarkable letter on astronomy?" It was quite true, and occurred some forty years before.

It would be impossible and unnecessary here to enumerate all his fugitive writings and the many things to which he turned his attention during his life, or to notice the testimony of those who knew his usefulness.

Through all his activity there glowed a very passion for the beauties of that extensive prospect at Pendarven and the glories of light and shade on the distant hills. This was to be expected in one ever looking out for perfection, and crying "Excelsior!" and often, while gazing on those splendid mountain sunsets, he was

"Rapt into still communion that transcends
The imperfect offices of prayer and praise.
Of him it might be said that he was found
By his intense conceptions, to receive
Deeply, the lesson deep of love."

He dearly loved his home, and delighted in listening to the music of his family. Yet like most men of imaginative wit, he was not only full of genial humour, but excitable, and ready with slashing sarcasm for obstructive stupidity and dishonesty. His family and friends can testify to his affectionate and attachable disposition. Indeed, his heart was too tender to admit of his ever joining in the ordinary country sports. He took delight in the songs and flight of birds, and never could hurt or shoot a living thing for pleasure.

The last few years of his life were spent in Bath, where he underwent much suffering, until he died on the 8th September 1878. But his mortal remains rest beside those of his eldest son in the Welsh churchyard of Llangenny, where he had so often listened to the rush of the mountain stream, and felt that all was to him a revelation of the Divine.

ROBERT HARKNESS was born at Ormskirk, Lancashire, on 28th July 1816. He was educated first at Dumfries, and afterwards at the University of Edinburgh; so that although English by birth he was Scotch by early training and residence, and even to the last was often supposed to be a native of the north side of the Tweed. It was while attending the lectures of Professor Jameson that he

had his attention specially directed to geological pursuits, and the influence thus communicated moulded all his after life. His first paper, published when he was twenty-seven years of age, was a speculative one, on the climate of the coal epoch, and contained ideas which have been adopted by some subsequent writers. A second paper, on changes in the temperature of the earth as a mode of accounting for the subsidence of the ocean, and for the consequent formation of sea-beaches above its present level, was read by him in the same year before the Geological Society of London. But in spite of this early promise of activity in theoretical geology, it was as a sedulous worker in the field that he distinguished himself. Though he made occasional geological excursions in Lancashire and Cheshire, he spent most of his early years in laborious traverses of the south of Scotland, exploring the old reptiliferous sandstones of Nithsdale and Annandale, the Carboniferous Limestone as it is developed in Dumfriesshire, and more particularly the Lower Silurian formations which stretch from the coast of Berwickshire to that of Wigtown. To his minute observations we owe the first outline of the general structure of the Silurian uplands of the south of Scotland. He followed the graptolite bands from valley to valley, and from parish to parish, and showed how they could be used as horizons to determine the succession of deposits in that difficult region.

In the year 1853 he was appointed to the Chair of Geology in Queen's College, Cork—an office which he held till his death. His residence in Ireland enabled him to bring the same diligent zeal to bear on the investigation of the geology of that island. From time to time he made valuable contributions to our knowledge of Irish geology, one of the most important being the paper which he wrote in the year 1860, on the metamorphic rocks of the north of Ireland, wherein he drew a parallel between the quartz-rocks, limestones, and associated rocks of Donegal and those of the west of Scotland. But he continued to devote much time to field-work in the north of England, and in Scotland. There is hardly a district which he did not explore; and though he did not always publish his observations, the number of his communications to the scientific journals of the day bears witness to his unwearied activity. He made himself the best authority of his time in the palæontology and stratigraphy of the Lake District and of Dumfriesshire.

The alteration of the curriculum of the Queen's Colleges in Ireland included a very great increase in the duties required of the professor of geology at Cork. Professor Harkness struggled with this accession of toil for two years, but finding it too much for his strength, and having some premonitory symptoms of the disease which ultimately cut him off, he resigned his chair, after having occupied it for a quarter of a century. It was his intention to settle at Penrith, to which place he had for many years been used annually to repair to spend a portion of his holiday with his sister. It was when on his way to carry out this intention that he died suddenly of heart-disease at Dublin, on 4th October 1878.

Important as was the scientific work accomplished by Professor Harkness, it did not receive a wider or heartier recognition among his brother geologists than his admirable qualities of head and heart. No one who has been privileged with his friendship will fail to cherish the memory of his earnestness over even the driest details, his quiet enthusiasm, his generous admiration for the work of others, and his unfailing cheerfulness. His beaming ruddy face, always full of kindness, was seldom to be missed from the platform of Section C at the British Association meetings. It often rose among the speakers, and it never failed to reappear at the festive evening gatherings. There have been men who have graven their names more deeply on the registers of scientific thought and progress, but there have been few whose sunny nature has more endeared them in the recollection of their friends than Robert Harkness.

A few words in conclusion.—Just twenty years have elapsed since I had the honour of delivering an address to this Society on its opening day. On that occasion, I took the place of Sir David Brewster, who was suffering from temporary illness. The feelings which arise on casting one's thoughts back through twenty years are full of sadness when they fasten on individual members of this Society, whose presence at our meetings was a source of pleasure not unmixed with pride, but of sadness, brightened by glimpses of the future when we think of them as members of a living body, as workers even now in the field which man has been sent into the world to cultivate—the field where truth is to be sought and found.

Great men like Sir David Brewster are not all lost to us; they live

and work in the impetus they have given to younger men, who hung about them when living, and fill their places when dead. This feeling is forced on me very powerfully by one fact which it was my duty to state in my former address. It was this. I said—"The annual addition to our Transactions this year (1857-8) contains but one paper. That paper is by Mr Stewart, and is of unquestionable merit. I have great pleasure in learning that Mr Stewart is continuing his researches on radiant heat, a branch of experimental science which owes so much to members of this Society, and the papers on which alone suffice to stamp our Transactions with lasting value." I need not say that the papers to which I referred were, for the most part, contributed by one member of the Society, the man who had for the previous twenty years of my connection with it most conspicuously illustrated in his own person the position which he himself lays down, that the vitality of a Society like this is kept up by a few ardent workers, whose contributions like the life blood trickle through the veins of the Society, and warm and animate its remotest members. Forbes was a man pre-eminently constituted to be a leader in a Society like this—cold, yet thoroughly affable; always at work, yet always accessible; keen and resolute in maintaining his own claims, yet ever open to the claims of those about him; and above all, straightforward even at the risk of treading on the toes of men with whom he might happen to come in contact. Forbes was one of two members of the Society whom I had the honour of knowing before I came to Edinburgh. He was introduced to be by Dr Whewell, and was ever my fast friend. Though perhaps a little out of place in such an address, I cannot resist the inclination, in holding up his ardent, hopeful character to the younger members of the Society, to read a portion of a letter which I received from him on his last return from the Continent to lie down and die. It is written in bed and in pencil. He says—

"I was very glad to hear from you. You will not expect a long reply. I am, in fact, very weak, though I made out the journey wonderfully, by the help of every luxury and indulgence which modern railways and hotels afford. Here on English ground I am content for the present to rest and be thankful; to leave the issue to a merciful Providence, in whose goodness and guidance I place my full reliance. Of course, I do not look at present to any further movement

It is most gratifying to me to know that you and other old friends still thought of me as a successor to Sir David Brewster [in the Principalship of the University]. *That*, of course, I at once surrendered. It was the last remaining rag of worldly ambition which remained to me, and I surrendered it cheerfully."

I have selected Forbes out of the many who are called up to memory by a reference to what I said in this place twenty years ago, both because he is most vividly associated in my mind with this room and this Society, and because he is about the very best type I could select of a man who derives benefit from the associations connected with a Society like this, and who in his turn reflects those benefits most powerfully on others. The solitary paper which I have mentioned as the sole product in our Transactions of the Session, was an early product of a mind lit up by a spark from Forbes's anvil. Balfour Stewart had been a worker in Forbes's workshop, and had imbibed much of the spirit of his master. He is now one of our Honorary Members; a fact which sufficiently expresses the opinion of this Society of the manner in which he has been doing his work. It would not become me to pursue the subject of the influence of one mind upon another, due to their close contact, by singling out some of the fervent workers in this Society as the insensible creations of the good men who have lived before them. The fact is patent. Good men have raised up good men to succeed them. Our Transactions of the present period contain papers not a few destined to take their place in the permanent repertories of science. We have about us workers whose praise is wide spread, but this is not the place to sound it. The only word I can venture on as both encouraging for the present and hopeful for the future, is the remarkable number of young men who are just entering on their work. In the fasciculus of the Society's Proceedings just issued, I count not less than eleven names of young men just entering on their career of investigation. How many of them have caught their inspiration from contact with those older workers who have been long among us! How many have been drawn out and cheered on by the associations of this room!